TOWARDS A NEW PHASE OF GROUNDWATER RESOURCE ASSESSMENT:
DIRECTORATE GEOHYDROLOGY WORKSHOP 3 NOVEMBER 2000

1. Introduction

The present national level groundwater resource assessment will shortly come to an end. It was initiated in 1991 and consisted of a national groundwater resource map at a scale of 1:1,5 million and a 1:500 000 million general hydrogeological map series (23 sheets). The national map was completed in 1995. The 1:500 000 series only came into a routine production in 1998 and is expected to be completed in 2001.

Since then the groundwater management objectives have changed dramatically from the general hydrogeological focus to one of large scale water service provision and to groundwater as a significant component of integrated water resource management as well as to the devolution of water services and water resource management as foreseen in the Water Services Act, 1997 and the National Water Act, 1998. The National Water Act also, for the first time, puts a responsibility on government to provide a national water resource assessment and national information system.

It is thus crucial to lay the foundation for a new phase of groundwater resource assessment in South Africa which must help take groundwater from:

- ‘private water’ status to that of a significant resource in Integrated Water Resource Management; and
- general hydrogeological maps to information supporting the requirements of two new Acts as well as the requirement for national monitoring and assessment and a national information system.

2. Inadequacy of present situation

Present inadequacies are summarized to show up broad areas for improvement.

- Harvest potential information is in big demand for national and catchment planning, but is used well beyond its conceptual and accuracy intentions;
- Outputs are paper maps rather than an effective request-driven information system;
- Poor population of the National Groundwater Data Base (NGDB), especially with regard to data from Water Services projects;
- Large water services contracts are launched without prior exploration or desk study;
- Available groundwater information (within Geohydrology and Water Services) is poorly utilized, e.g. Water Services Business Plans only guess with regard to groundwater;
- A lot of critical project data / information does not end on the NGDB (e.g. WRC projects);
- The detailed geological information of the Council for Geoscience is virtually not used.

3. Major user requirements

3.1 Water resource planning

This need has been well illustrated through the recent scenario planning for 19 Water Management Areas. It includes:

- Catchment-wide information down to quarternary level;
- Focus on bulk water supply, *i.e.* need for locally improved information where groundwater has high yield potential;
- Sustainable yield and water quality information;
- Quantitative information on hydrological regime, *i.e.* the interchangeability of groundwater with surface water;
- Comparative information on development cost of groundwater.

3.2 Water use allocation

Water use allocation requires different levels of information, depending on level of risk of impact, moving from Schedule 1 and General Authorization to licences and allocation plans.

Needs may differ between clients, e.g.:

DWAF: Water Resource Planning (catchment)
Resource Directed Measures (aquifer);
Resource Quality Objectives (local impact).

Catchment Managagent Agency
As DWAF, plus resource conservation and use optimization (catchment).

Water User Associations
Local level management (aquifer and local impacts).

Crucial information needs are:

- Present groundwater use (the bigest unknown)
  - improve through registration
  - remote sensing as important tool
  - note that schedule 1 use in urban use may also be high in total and is already stressing a number of systems, e.g. Bainsvlei aquifer near Bloemfontein
- Groundwater recharge information
- Monitoring to establish background conditions and to manage possible impacts.
- Quantifiable assessment of resource
  - sustainable yield (quantity and quality)
- Practical management strategy and control measures based on monitoring
- Periodic re-assessment of resource status
  - groundwater input and environmental demand varies (dynamic hydrological cycle)
- Integrated resource management

3.3 Water resource protection

Use and protection should be analysed together. Resource protection, and in particular aquatic ecosystem protection, requires new data sets e.g.

- hydrological system behavior;
- groundwater flow;

- ♦ impacts at recharge and discharge parts of system;
- ♦ system boundaries;
- ♦ protection zoning information;
- ♦ expression of risk of impacts.

3.4 Water Services

The groundwater component of water services information should, as far as possible, be integrated with:

- other resource information;
- infrastructure and use information;
- impact information (health, environment, development).

Information provision should be prioritized based on implementation priorities:

- all existing RDP project data must be available;
- the information system must be flexible to produce required information products on demand (REGIS to achieve this);
- user focus is crucial;
- system development should focus on methodology and not maps.

Overall, the Struckmeier (1989) matrix (Fig1) of information needs for the groundwater field is still a good summary, but information must be available on demand, rather than as printed maps.

4. Objectives and principles for a new assessment phase

Planning ahead cannot be for more than 3-4 years, because the groundwater management environment is changing dramatically through the creation of new institutions at catchment and aquifer level.

The key requirements are user focus and timeousness of information products during the present water management transformation phase.

Key principles for this phase are:

- ♦ Information products must be provided for the main user focus areas (catchment, aquifer, water development area);
- ♦ Spatial reference of data / information is essential;
- ♦ New development should focus on a standard toolbox of methodology;
- ♦ All levels of management, from national / regional to local, must be addressed;
- ♦ A differentiated approach should be followed, focusing on different priorities in different Regions;
- ♦ For maximum efficiency and continuity, interpreted geo-referenced data sets, e.g. an aquifer analysis for a licence assessment, should also be stored for regular re-use and updating.

5. Conceptual outline of assessment system

5.1 To be able to ensure the meeting of user needs, a systematic approach to the development of assessment procedures should be followed, working back from:

- ♦ decision drivers, e.g. new legislation;

- ♦ required decision-support information products;
- ♦ standardized tools;
- ♦ information layers;
- ♦ data.

5.2 The new information system should:

- ♦ move towards a hydrological systems framework with linkages of surface water / groundwater, quantity / quality, catchment / aquifer, water resource / aquatic ecosystem / terrestrial ecosystem;
- ♦ move towards an integrated allocation model with provision for conjunctive use and balancing of use and protection;
- ♦ strive towards greater efficiency of information use from various sources, both internal and external. Data exchange standards will become essential;
- ♦ very strongly rely on systematic monitoring of water resources and impacts and should provide direction for such monitoring;
- ♦ The drive towards effectiveness and efficiency should be supported by the development of:
  - an eco-hydrological classification system,
  - conceptual models central to the groundwater data base for the main typical aquifer systems,
  - installed decision-support models, once clear and regularly required outputs emerge.

6. Data capture as critical component

Adequate data is critical to resource assessment. Present data capture is completely inadequate. Major flaws are:

- no strategy;
- no standards;
- little capacity in Regions;
- no incentives for private sector.

Going into the new assessment phase, the above-mentioned flaws must be dramatically improved.

More intensive data and additional data sets from both internal and external sources will be required for certain critical applications, eg. Reserve determination.

The issue requiring policy and regulatory attention is the obtaining of information from consultants, who collect some 90% of all information and do so for a rapidly increasing and less informed clientele. A strategy is urgenly required which provides for:

- registration of consultants / contractors;
- standards of good practice, for different types of work including data collection and provision;
- incentives to support data provision;
- a win / win approach starting on a voluntary basis.

7. Short term priorities

7.1 Re-assessment of Harvest Potential / Exploitation Potential

This should be done, following the user-focussed approach outlined in 5.1 and improving methodology and input information layers, wherever this is possible within the next 6 – 12 months.

- Re-define outputs with clients;
- Standardize and, wherever possible, simplify methodology, e.g. storage assessment;
- Improve national groundwater recharge information layer:
  - Relate to homogeneous recharge regions;
  - Do the standard recharge methodology for each region;
  - Distribute the average result per region further, based on a rainfall / evaporation adjustment;
- The reliability of the output should be flagged;
- Address methodology from macro to micro scale.

In the longer term, the surface and groundwater resource assessments nationally and for primary catchments should be done jointly, using the same hydrological system concepts and common input data and parameters.

7.2 Support of groundwater development for water services

Information is required for:

7.2.1 Planning purposes:

Availability, Suitability, Exploitability and Accessibility.
All these can be obtained from the present NGDB data sets, a few additional algorithms and the use of REGIS.
The much bigger constraint is that the RDP data is not yet on the NGDB.

7.2.2 Development support

Effective and efficient groundwater development on contract by an increasing number of agencies needs good information on appropriate targets and target areas plus the appropriate source development approach and development risk for these areas and targets.

For well-understood areas such information can be obtained from desk studies. In complex, little understood areas an exploration phase providing the same information should precede the implementation phase. This is, for example, standard practice in Botswana.

Both the desk study and exploration phase require expertise and data which are not available in the Department nor with normal groundwater consultants. The specialized geological data and interpretation resides mainly in the Council for Geoscience.

8. Support strategies

8.2 Geohydrology capacity

The present geohydrological capacity in DWAF Head Office and Regions will not allow the dramatic increase in output and user focus. It is felt that this may be impossible to achieve in the present Public Service environment. International experience points to a hydrological service outside the government regulatory function. This important issue should definitely be addressed in the DWAF – restructuring process.

In the interim the funds for contracting out methodology and system development should be doubled to achieve the high priority short to medium term objectives.

8.2 Strategic alliances

Given both the capacity and expertise problems, strategic alliances should be forged which can overcome the medium term bottlenecks.

8.2.1 Council Geoscience

The Council for Geoscience possesses the specialized geology (structural geology, lithology, geophysics) expertise and regional capacity as well as data bases required for the new hydrological system approaches and for water services support.

A formal outsourcing agreement should be developed with the Council without delay.

8.2.2 Universities / Technikons

Masters bursaries should be provided to each Region centre of expertise to analyse and systematize and capture all available data and information for that Region for the National Groundwater Data Base.

8.2.3 Water Research Commission

Groundwater experts undertake WRC funded research on critical subjects throughout the country. This could provide an excellent capacity building opportunity for inexperienced geohydrological staff in Regions who also lack experienced supervision. This could be achieved at no extra cost through a policy decision and some organization.

9. The way forward

Because of the very dynamic nature of water resource management implementation and the sudden window of opportunity for groundwater, an immediate action programme is required not to loose momentum. The following are essential actions:

- Obtain Management and Region commitment to the strategy;

- Define roles and responsibilities in both Head Office and Regions to take the strategy forward;
- Define short-term goals and prioritize new information products;
- Obtain the required staff and budgetary resources;
- Develop the required strategic alliances without delay;
- Make REGIS development the core of the strategy;
- Give highest priority to overcoming the data capture bottlenecks;
- Utilize the DANCED-assisted programme on IWRM as a main vehicle to pilot the new approaches together with clients and other hydrological service providers;
- A big awareness-building drive must be run in parallel to increase groundwater understanding of decision-makers at all levels;
- Assess the emerging groundwater functions of management, development support and assessment as part of the DWAF restructuring process, with strong consideration for an external geohydrological service.

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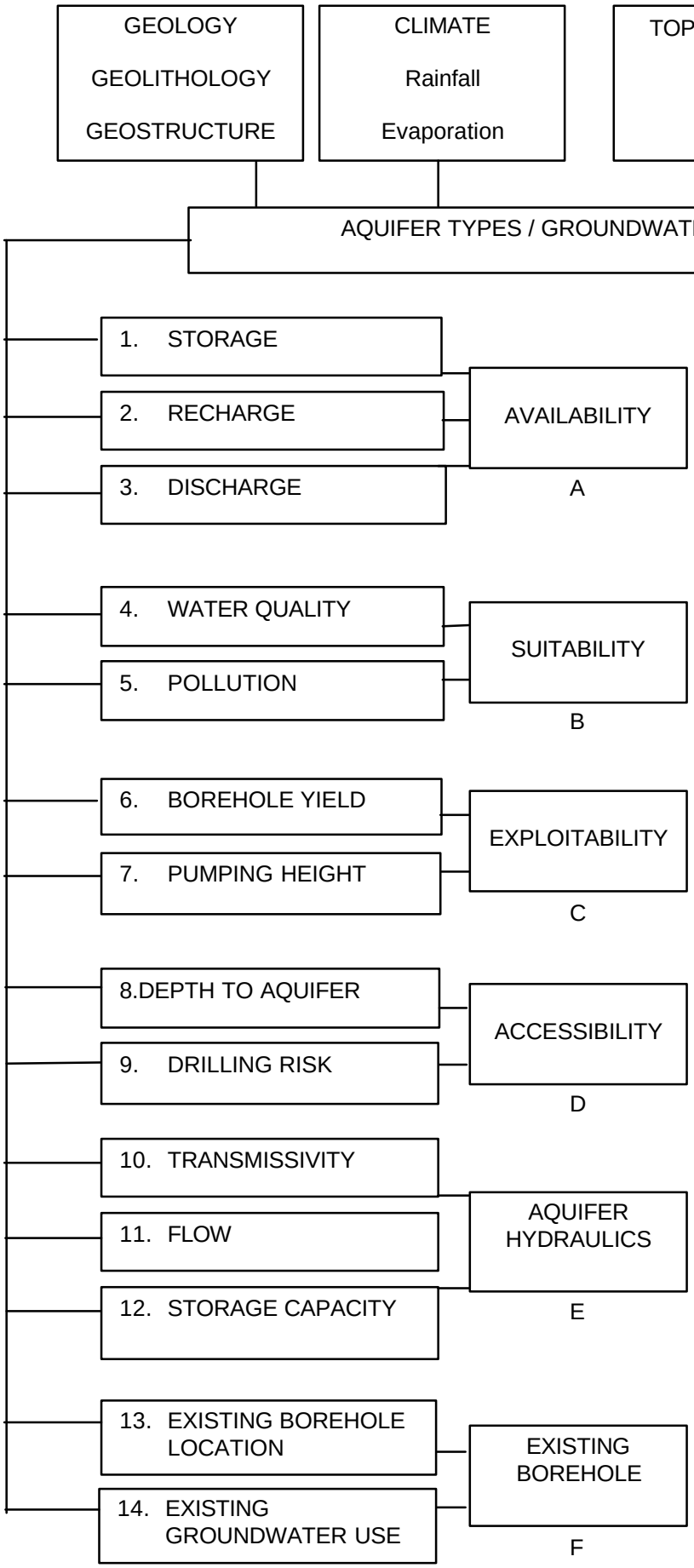

User Requirements	Type of Needs			Type of Info
Planner / Educator				
Strategic Planning DWAF	A	B		1-5
Regional Planning DWAF – Catchments DBSA National States RSC	A	B	C	1-7,9
Local Planning DBSA Agriculture Landbank Water Boards Rural Water Supply	A D	B F	C	1-9,11 13, 14
Practitioner				
General Consultant	A D	B F	C	1-10,13, 14
Specialist Consultant	A D	B E	C F	1-14

FIG.1
MATRIX OF HYDROGEOLOGICAL MAPPING NEEDS

From : Struckmeier (1989)